

Fluvial Channel Networks as Analogs for the Ridge-forming Unit, Sinus Meridiani, Mars

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Fluvial models have been generally discounted as analogs for the younger layered rock units of Sinus Meridiani. A fluvial model based on the large fluvial fan provides a possibly close analog for various features of the sinuous ridges of the etched, ridge-forming unit (RFU) in particular. The close spacing of the RFU ridges, their apparently chaotic orientations, and their organization in dense networks all appear unlike classical stream channel patterns. However, drainage patterns on large fluvial fans—low-angle, fluvial aggradational features, 100s of km long, documented worldwide by us—provide parallels. Some large fan characteristics resemble those of classical floodplains, but many differences have been demonstrated. One major distinction relevant to the RFU is that channel landscapes of large fans can dominate large areas (1.2 million km² in one S. American study area). We compare channel morphologies on large fans in the southern Sahara Desert with ridge patterns in Sinus Meridiani (fig 1).

Stream channels are the dominant landform on large terrestrial fans: they may equate to the ubiquitous, sinuous, elongated ridges of the RFU that cover areas region wide. Networks of convergent/divergent and crossing channels may equate to similar features in the ridge networks. Downslope divergence is absent in channels of terrestrial upland erosional landscapes (fig. 1, left), whereas it is common to both large fans (fig. 1, center) and RFU ridge patterns (fig 1, right—downslope defined as the regional NW slope of Sinus Meridiani). RFU ridge orientation, judged from those areas apparently devoid of impact crater control, is broadly parallel with the regional slope (arrow, fig. 1, right), as is mean orientation of major channels on large fans (arrow, fig. 1, center). High densities per unit area characterize fan channels and martian ridges—reaching an order of magnitude higher than those in uplands just upstream of the terrestrial study areas—fig. 1.

In concert with several other regional features, these morphological similarities argue for the RFU as a possibly fluvial unit.

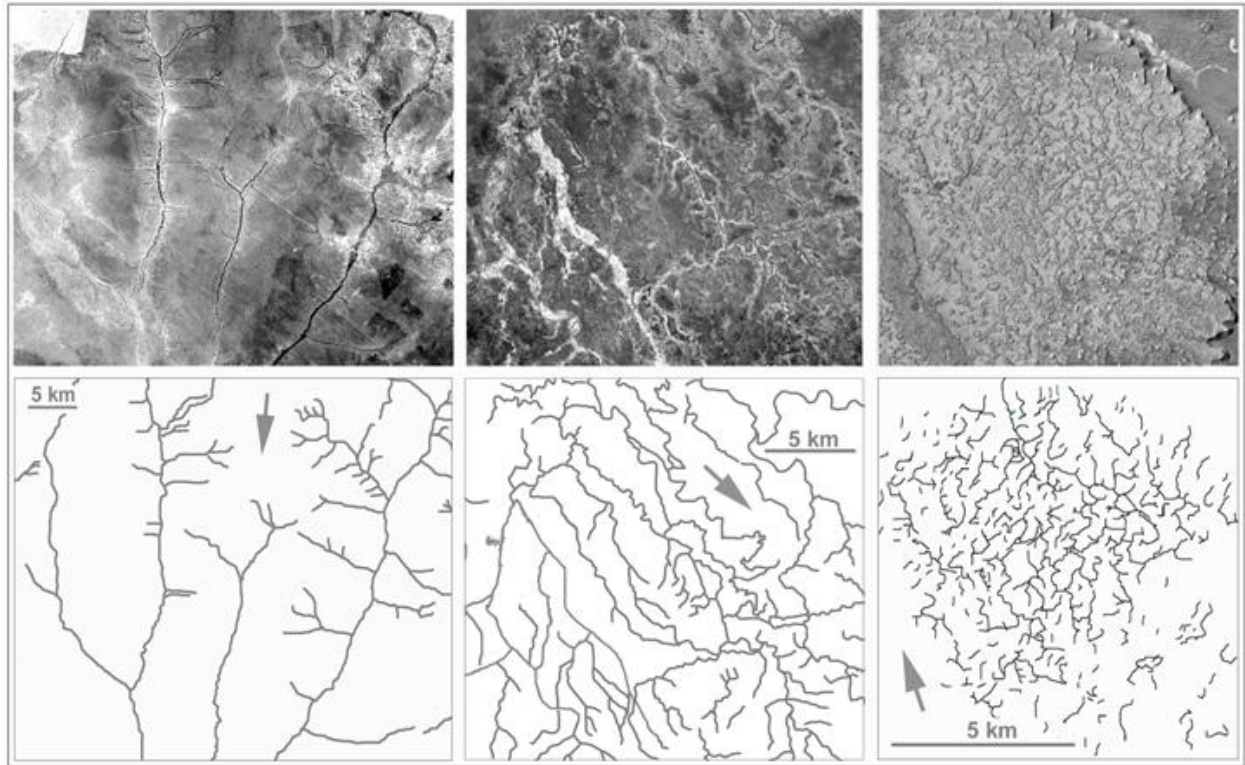


Figure 1. Channel patterns in Saharan upland and lowland landscapes, compared to RFU ridge patterns. Left panel—southern Sudan uplands (ctr 11.1N 28.4E); center panel—part of a large fan, Muglad basin, immediately downstream of sediment-source upland shown in left panel (10.15N 28.6E); right panel—discontinuous inverted ridge patterns, Mars (ctr 2.1N 1.0W). Arrows show direction of regional stream flow (left, center panels) and regional slope in Mars study area (right panel). North to top.